



MODERN DATA

**technology
profile:
computer
output
microfilm**



COMPUTER OUTPUT MICROFILM SYSTEMS

It has become apparent that a bottleneck has developed in the generation of output information from a computer system. Although the internal computer speed has increased significantly, output is still primarily limited by the speed of the line printer. An alternate solution to the printer which has been gaining favor is the use of Computer Output Microfilm (COM).

In a computer system utilizing COM, information is outputted by means of a microfilm process using a COM recorder. Information is outputted directly on-line from the computer, or off-line from tape drives, many times faster than the highest speed line printer.

When viewed by a microfilm reader, the information on each frame (page) appears exactly as it would on a regular printed page. In addition, various retrieval and indexing codes may be automatically generated by the COM onto mi-

crofilm. Through the use of these codes, information may be located faster than on a comparable paper information system.

Storage and mailing costs are greatly reduced by using COM, since microfilm requires only 2% of the space of an equivalent paper report. Additional copies of the microfilm have practically the same quality of the original, and many times the quality of a third, fourth, or fifth carbon paper copy. Since information can be outputted from the computer rapidly and inexpensively, many companies find it economically feasible to "print out" data base information and other detailed reports much more frequently.

Computer Output Microfilm provides for the rapid output of information from a computer system at significant cost savings, while increasing the total thruput capabilities of the computer and the accessibility of the data.

COM RECORDERS

Three techniques, employing cathode ray tubes (CRT), electron beam recording (EBR), and fiber optics, are employed in COM recorders. CRT and EBR produce one page of information at a time; fiber optics produces one line at a time. The CRT technique is the oldest, and the most commonly used in COM recorders today.

Cathode Ray Tube

Information is written one page at a time by an electron beam exciting the phosphor face of a CRT. The image from the face of the tube is passed through a semi-reflective mirror and a lens onto the unexposed film. After exposure to the image, the film is advanced, and the next page is displayed on the face of the CRT. Simultaneously, as the data is exposed on the film, a flash can occur behind a glass or film slide on which a form of the paper report has been etched. The form image is reflected by a semi-reflective mirror, and is superimposed on the image of the data on the film (Fig. 1).

Electron Beam Recording

In this technique, characters are written by an electron beam directly onto the unexposed film. The process is performed in a vacuum. The un-

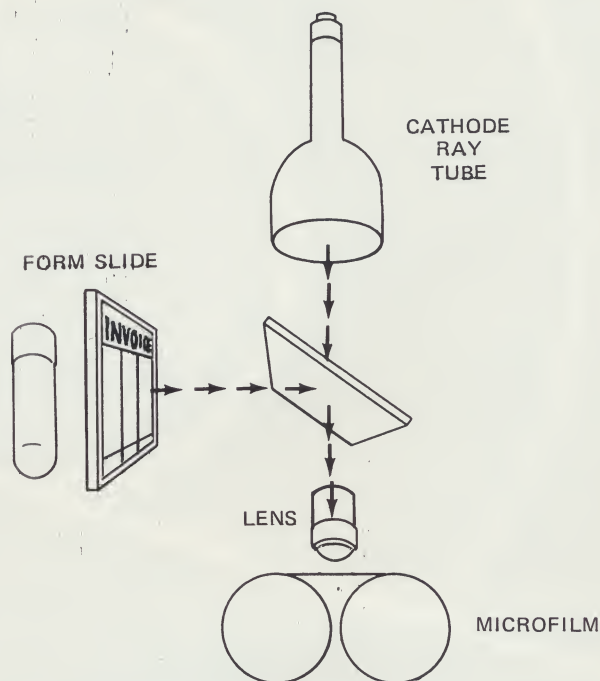


Fig. 1 CRT Recording on Microfilm

posed film is drawn into the vacuum chamber and the page written one character at a time onto the film. After the information is written by the electron beam, the film is incremented, and the next page written. If a forms overlay is desired, it is placed on the film through the use of a second lens system (Fig. 2).

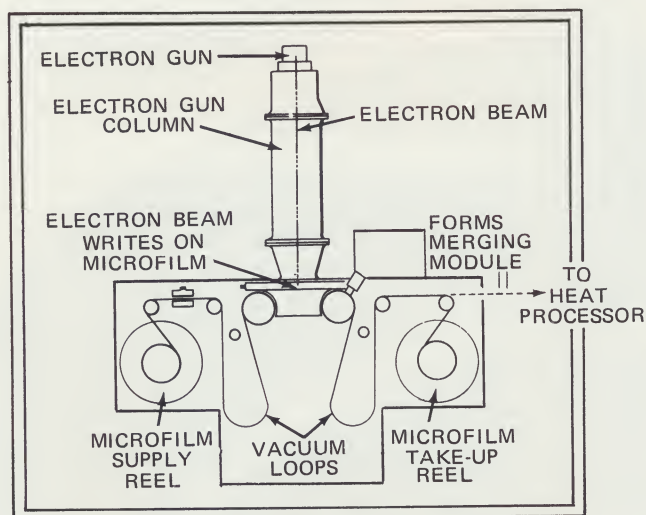


Fig. 2 Electron Beam Recording on Microfilm

Fiber Optics

The selective illumination of a matrix of luminous fibers forms the characters in a single line of data. After being exposed, the film is slightly incremented to permit the next line of characters to be exposed onto the film. As in EBR, if a forms overlay is desired, a second lens system is employed (Fig. 3).

The above techniques are the most commonly employed in COM recording devices on the market today. CRT technologically, was the easiest to perfect. EBR requires the passing of the film into and out of a vacuum chamber, with the precise formation of individual characters with an electron beam. Naturally, this more exacting technique required more time to perfect. However, because

the film is directly exposed to the electron beam, the use of EBR permits the dry processing of the film, as opposed to the wet processing most commonly associated with microfilm. The fiber optics technique would appear to have been the simplest to perfect. Although the electronics are less complex, the exacting tolerances required for moving the film at a line increment required time to perfect. Also, if the fibers retain the image of the character as the film is advanced, a smearing effect could occur.

All three are offered on the market today. Since figures are not available to compare the reliability of these approaches in detail, care should be taken by a prospective COM recorder purchaser to talk

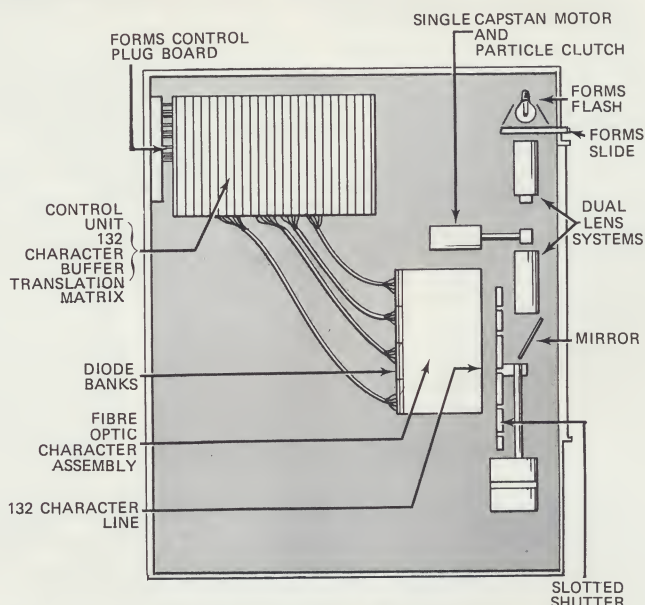
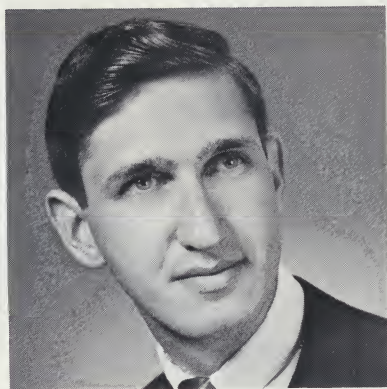


Fig. 3 Fiber Optics Recording on Microfilm



Mr. Gildenberg, currently with Bowne Time Sharing, was formerly Executive Vice President of C.O.M. Systems, Inc., a COM service bureau in N.Y.C. Prior to this, Mr. Gildenberg was Sr. Analyst in IBM's Data Processing Group.

Mr. Gildenberg has directed the design and implementation of numerous computer and com-

puter-microfilm systems. He was also responsible for the presentation of a series of seminars on the development of microfilm information systems.

Mr. Gildenberg has been a guest speaker for the Association for Systems Management, and is a member of the American Management Association.

with existing customers to ascertain what problems, do exist with the implementation of any of these techniques in a particular COM device.

CHARACTER GENERATION

The major methods used to generate characters in COM devices are stenciling, stroke generation, or dot generation.

Stenciling

A stenciled wafer, approximately the size of a quarter, is enclosed in the neck of the CRT (Fig. 4). To form a character, the electron beam in the CRT is directed to the appropriate point (character) on the wafer. The proper placement of the

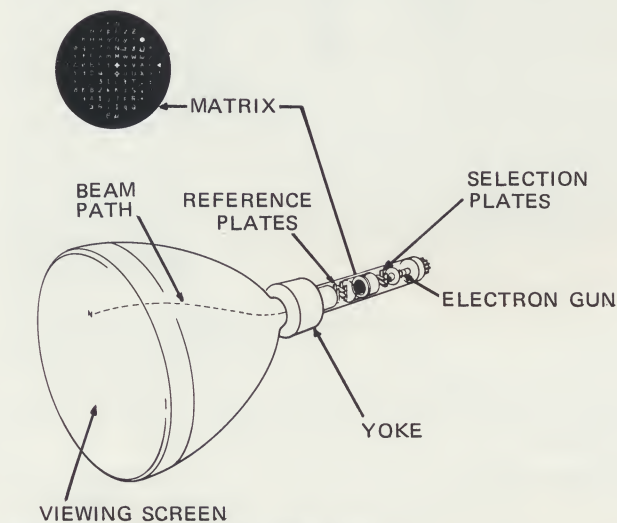


Fig. 4 Use of a Stencil-Type Wafer

character on the face of the CRT is achieved by the use of deflection fields. This method, called Charactron by its originators, Stromberg-Carlson, has worked well for many years. The character set is, however, limited to the number of characters etched in the stenciled wafer.

Stroke Generation

In this method, the characters are literally "stroked" onto the face of the CRT by an electron beam. Stroke generation requires more electronics than either the Charactron or the dot generation methods. The additional electronics are required to shape and place the page of characters on the face of the CRT, or onto the film directly. A major advantage is the ability to introduce additional characters and character sets by merely changing or adding circuitry to redirect the electron beam. The quality of the characters, in general, also tends to be better.

DOT GENERATION

In dot generation the selective activation of dots in a matrix forms the individual characters. Unlike the stroke generation of characters, the electron beam is always directed at discreet points on the face of the CRT. Therefore, electronics tend to be simpler, with a general reduction in cost. A disadvantage is the difficulty some manufacturers have in achieving as high a quality character as can be achieved by the Charactron or stroke generation methods.

Dot generated characters are also used in COM recorders utilizing fiber optics. In these devices the characters are formed by the selective activation of a matrix of luminous fibers. By eliminating CRT electronics, cost, once again, can be reduced.

FORMS OVERLAYS

Many reports and documents require the use of certain page formats. Company logos, headings, column designators and tabulations are sometimes required in displaying data on a page.

The most commonly used method of forms generation in COM recorders employs film or glass slides. In a less commonly used method the form is drawn by the electron beam according to specification encoded in a program stored in the COM computer, or in the data tape. This method is used by COM recorders with "graphic" capabilities.

Film Slides

Film slides have the advantages of being inexpensive and easy to prepare. Disadvantages are the adjustments required for proper forms placement and handling degradation of the slide.

Glass Slides

Advantages in using glass slides for forms overlay are ease of forms placement and good resolution, while disadvantages are the cost and time involved in glass slide preparation.

Programmed Merge

Programmed merging has the advantages of ease of placement and excellent resolution; disadvantages are a reduction in thruput rate when forms are complex, and the need for programming lines and text, and to digitize logos.

Overlay Exposure

Three methods are used to superimpose the form onto the page of data. The first involves the use of a semireflective mirror (Fig. 1). As the data is reflected from the face of the CRT onto the film, a bulb is flashed behind the form slide. Its image, along with the data, is simultaneously exposed onto the film. The second overlay method involves

the use of a second lens system to place the form onto the film on which the data has already been placed (Figs. 2 and 3). The third involves the tracing of the form directly on the face of the CRT around the image of the data.

CHOOSING A COM SYSTEM

Most COM systems offer a variety of features and options. Some of these may be important for particular applications. However, options on the recorder are obtained only by additional cash outlay. Therefore, a thoughtful preliminary study of immediate and short-range COM applications is warranted before choosing a COM system. This type of analysis will lead to a decision in choosing a system with sufficient options for growth, but without those options for which there will be little, if any, need.

Graphics Capability

For most companies, the likelihood of placing graphics onto microfilm via COM are months, if not years, away. If this is the case, why insist on getting a COM with graphic capability? As an alternative, if 98% of the COM recording will be alphanumeric, why not use a service bureau to produce the 2% of the work that will be graphic? This is not meant to imply that no one should purchase a COM system with graphic capability. The importance of the presence or absence of graphic capability should be considered in light of the job mix to be placed on COM.

Character Quality

The quality of the characters (and graphs) will vary dramatically from one COM to another. When considering various COM recorders, insist on seeing a complete set of characters and samples of graphics. Study them carefully. Don't forget



UCC-Graphic Systems Division Model 300-3 microfilm printer/plotter with companion tape drive.

that operators and other personnel may be looking at these characters eight hours a day, five days a week. Saving a few hundred dollars in rental is never sufficient reason to have unhappy personnel, some of whom may unintentionally, or otherwise, begin to undermine your plans for placing further applications onto microfilm.

Servicing

No feature, or savings in rental, can give sufficient reason to sacrifice the speedy servicing of the COM recorder. This point cannot be over-emphasized. A COM recorder in New York City, with parts and servicemen readily available only on the West Coast, is useless. If possible, talk with other customers using the recorder you are considering to determine the quality of servicing by the manufacturer.



The Kodak KOM-90 microfilmer shown with the new Versaform camera which accommodates five film widths at reduction ratios up to 42:1.

On- vs. Off-line

Few questions are generating as much discussion as the advantages and disadvantages of having the COM recorder attached to the computer directly (on-line), or away from the computer, using a magnetic tape or disk as the recorder's input (off-line).

Basically, some of the advantages of each are as follows.

On-line

- Many times the thruput over the fastest line printers.
- The job is run from input through final output as one operation.
- Less expensive, generally, than off-line COM.
- No special programming changes required. To the computer, the on-line COM recorder is just like any other output device.

Off-line

- Information can leave the computer at tape speed, which can be significantly faster than on-line COM operation.

- If the job must be rerun for any reason (poor developing of the film, operator error in loading proper form slide, etc.), no additional computer time need be used.
- COM recorder can be physically located away from the computer room. Since all on-line COM recorders currently require wet-film processing, this may be of some significance in determining which operations staff will perform the microfilm processing.
- Wider selection of options. On-line COM recorders generally have fewer options in font size, image rotation, etc. than do off-line COM recorders.

Thruput

One of the fundamental measurements of thruput is lines/minute or pages/minute. However, the true measurement of thruput is not necessarily directly proportional to either of these. Rather, the manual problems involved in setting up a job may far outweigh the advantages of a slightly faster speed when measured in pages/minute. Many factors, such as form slide insertion and alignment, and job control through plug board, punch card, or computer program, will determine the true thruput of the COM system. Also, when a COM system is simple for an operator to set up and use, the likelihood of operator intervention, or operator error, is minimized. To determine and evaluate this type of factor, attempt to see a demonstration of the COM in operation—not for one job, but a series of varied jobs.

Input Operations

Naturally, on-line and off-line defines the major option for input for a COM. For off-line devices, however, a number of other considerations are important to recognize and evaluate. One of the more important is the bpi options for the COM. Why get a recorder unable to read 1600 bpi magnetic tapes if that is the primary output media from your computer? Also, if you are currently using "print-image" tapes for a number of computer applications, the ability of the COM to accept this type of tape format is a factor in making your choice. It should be understood, however, that the use of a print-image tape has two major disadvantages when used on a COM system. First, the thruput of the COM is generally poorer than that of a tape specifically formatted for the COM recorder. Second, many of the retrieval codes, so valuable in designing an effective microfilm system, are unavailable if a print-image tape is used as input.

Orientation

Comic rotation (0 degrees) is similar to the man-

ner in which comic strip pictures are oriented. Cine rotation (90 degrees) is similar to the manner in which the images on motion picture film are oriented. The advantages of cine or comic rotation lie in the ability to pack more images (frames) onto each roll of microfilm. Comic rotation can be effectively utilized when the page of information is narrower than normal, but with a normal depth. Cine rotation is used when the page of information is $\frac{1}{3}$ to $\frac{1}{2}$ the normal depth of a computer size page, but of normal width. By advantageously using cine and comic rotation, some COM recorders provide the ability of packing up to three times the number of frames on a roll of microfilm.

Character Sets

The number of characters, sizes of fonts, italics, and lower case letters are some of the variations in character sets offered by COM manufacturers. However, it should not be assumed that, because two COM systems appear to have the same capabilities on paper, the output from both will appear identical when viewed on a microfilm reader.

Oversize Pages

Applications exist where more than 132 characters per line, and more than 64 lines per page would be desirable. Some COM recorders can provide this type of capability. Examination of the potential COM applications will determine the importance of this feature.

Summary

Many differences exist between the various COM systems on the market today. Table 1 attempts to summarize some of the features of these devices. In determining which system most closely meets your requirements, the following is suggested.

- *Analyze the applications which will be placed on the COM for the next twelve to eighteen months. This analysis should focus on the need for such features as graphics, retrieval code generation, and lower case capability.*
- *Having completed this preliminary analysis, refer to Table 1, and use the reader inquiry card (and Table 2) to obtain manufacturers' literature for determining which recorders provide the particular combination of the features desired.*
- *Begin the process of reviewing the specifics of each COM system, including output quality, reliability and serviceability, and, finally, price.*